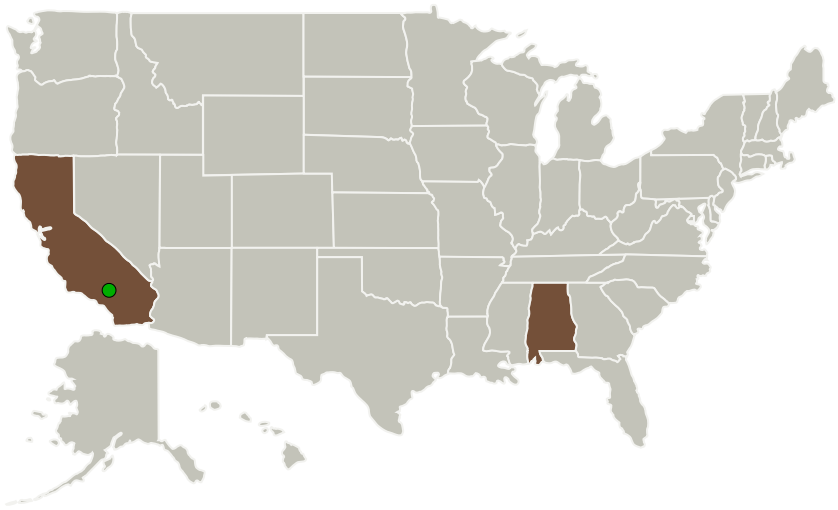
Low Cost Refractory Matrix Composite Thruster for Mars Ascent Vehicles, Phase I

Completed Technology Project (2012 - 2012)

Project Introduction

The long-term goal for this effort is to develop a low-cost, high-temperature thruster. Within the attitude control propulsion community, many efforts have focused on development of ultra-high temperature precious metal alloys and systems that give long life and good performance (e.g., Ir/Re). Those designs are driven by the desire to operate the thrusters at very high temperatures, which increases Isp performance through a reduction in the amount of film cooling needed. The results have been thruster technologies plagued by high costs and low manufacturability. This approach of "performance at all cost" is no longer tenable, particularly for robotic exploration/science missions like Mars Sample Return. Therefore, we seek a different approach. We believe we can achieve state of the art (perhaps better) levels of performance, with significant reductions in cost. The focus of our innovation is on the development of a refractory matrix composite material that uses cheap, commercially available materials and then use fast, affordable manufacturing techniques to make a low cost, high performance thruster. Our starting materials are two order of magnitude cheaper than Ir/Re systems! Our proposed manufacturing process is likewise low cost, further contributing to the overall low cost thruster. The basic Phase I project includes small scale fabrication experiments to identify the manufacturing parameters needed to achieve a fully-dense composite. Then, we will fabricate sample coupons of various composition and measure hardness (as a relative indicator of tensile strength), to determine the range of composite parameters that will give the highest specific strength.

Primary U.S. Work Locations and Key Partners



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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Analytical Services, Inc.(ASI)	Lead Organization	Industry Small Disadvantaged Business (SDB)	Huntsville, Alabama
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations	
Alabama	California

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138264)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Analytical Services, Inc. (ASI)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

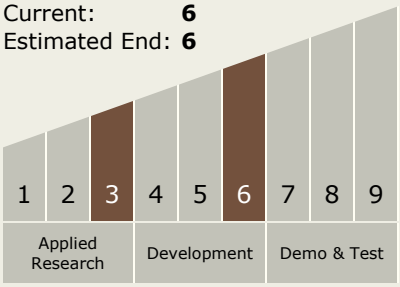
Carlos Torrez

Principal Investigator:

Joseph D Sims

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.3 Electromagnetic

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System